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Description

STRETCHER, STRETCHER SYSTEM AND METHOD FOR USING STRETCHER

Technical Field

This invention relates to a stretcher, a stretcher system and a method for using a stretcher.

Background Art

When ambulance officers carry a sick or injured person into an ambulance vehicle, a stretcher with foldable legs is conventionally used. Stretchers of such kind are each made up of a bed on which a sick or injured person will be laid and foldable legs, and typically used by two ambulance officers as follows.

After the ambulance officers transfer the stretcher to a site at which a sick or injured person exists, they fold up the legs of the stretcher, lower the bed to the ground and then lay the sick or injured person on the bed. Thereafter, both the ambulance officers lift up the bed at a time with one holding the head side of the bed and the other holding the feet side thereof. With ascent of the bed, the legs automatically deploy by self-weight. As a result, the stretcher stands up. When the bed is raised to a predetermined level, the legs are locked in a fully deployed position to support the bed. Then, the ambulance officers roll the stretcher on the ground while pushing or pulling it and then carry it into the ambulance vehicle.

Since the total weight of the bed and a sick or injured person is substantially great, a large force is required to lift up the bed. The bed lifting work is normally done by two ambulance officers, but the physical burden for each officer to do that work is considerably large. For example, when the total weight of the bed and the sick

or injured person is 120kg, the physical burden per officer is approximately 60kg. Therefore, it is difficult for an ambulance officer with less muscle to smoothly do the lifting work.

Furthermore, in the initial stage of the lifting work, i.e., before the bed is lifted up to a certain level (for example, the level of the ambulance officer's waist), the ambulance officers must stoop to lift it up. Therefore, they are likely to experience excessive physical burdens on their body parts (especially waists). Hence, they often strained their body parts, particularly in the initial stage of the lifting work. In addition, it is difficult that people exert large strength in stooping positions. Therefore, it is difficult for ambulance officers to exert their full strength in the initial stage of the lifting work.

In order to reduce the physical burden of the lifting work, a leg standing mechanism for a stretcher is proposed in which a lockable gas damper is provided to use the repulsive force of the damper to assist the deployment of the legs (see Japanese Registered Utility-Model Publication No. 3058160).

For the stretcher with a leg standing mechanism, however, ambulance officers must apply an extra force to the bed against the damper's force when folding up the legs. Therefore, its convenience is poor. Further, since the repulsive force of the damper is not so much larger than the weight of a sick or injured person, it is hard to say that the physical burden of the lifting work is reduced enough. If, conversely, the repulsive force of the damper is increased, the force required to fold up the legs is also increased accordingly. Therefore, in consideration of the folding of the legs, it is impossible to increase the repulsive damper force so much. In conclusion, it is difficult for any prior-art stretcher to extensively reduce the physical burden of the lifting work.

Furthermore, in carrying a stretcher in an ambulance vehicle, the stretcher is normally put on a support platform (the floor of the ambulance vehicle or a platform

mounted on the ambulance vehicle, such as a vibration isolation platform) by a single ambulance officer. Specifically, the ambulance officer releases the legs from their locked state and pushes the stretcher into the vehicle from rear so that the stretcher can ride on the support platform.

In order to put the stretcher onto the support platform, an ambulance officer must push the stretcher onto the support platform while keeping the bed of the stretcher raised (in other words, keeping the legs deployed). Therefore, the ambulance officer is required to exert a force to keep the raised position of the bed and a force to push the stretcher onto the support platform. Since, however, the total weight of the stretcher on which the sick or injured person is laid is considerably large, a large physical burden is imposed on the ambulance officer when the stretcher is carried into the ambulance vehicle.

To cope with this, Japanese Unexamined Patent Publication No. 2002-153512 proposes a stretcher transfer system which includes a hook for guiding a stretcher onto a support platform mounted on an ambulance vehicle and a chain for winding up the hook in order to automatically draw the stretcher onto the support platform.

Since the above transfer system automatically draws the stretcher, this can reduce the force for an ambulance officer to push the bed onto the support platform. However, the transfer system cannot reduce the force to keep the bed raised. Therefore, for any ambulance officer with less muscle who has difficulty in supporting the weight of the stretcher, it is difficult to carry out the carrying-in of the stretcher.

Furthermore, in carrying the stretcher into the ambulance vehicle, the locking mechanism for the legs must be released. At the moment of release of the locking mechanism, the whole weight of the stretcher is applied to the ambulance officer. Therefore, even an ambulance officer with sufficient muscle was likely to strain his body part (especially the back) due to shock at the moment of release of the locking

mechanism.

Disclosure of the Invention

With the foregoing in mind, the present invention has been made. An object of the invention is to extensively reduce the physical burden of lifting of the stretcher and to make it possible even for a person with less muscle to smoothly lift up the stretcher. Another object of the invention is to reduce the force required to keep the raised position of the bed in putting the stretcher onto the support platform thereby reducing the physical burden on the lifting worker. Still another object of the invention is to make it possible even for a person with less muscle to put the stretcher onto the support platform.

A stretcher of the present invention is a stretcher including a bed on which a sick or injured person will be laid, legs foldably provided on the bed and casters provided at the legs, respectively.

The above stretcher further comprises an ascent assist device having: a lifting mechanism for giving the bed an ascending force; and a switch for turning the lifting mechanism ON/OFF.

Another stretcher of the present invention is a stretcher including a bed on which a sick or injured person will be laid, legs foldably provided on the bed and casters provided at the legs, respectively, and the stretcher further comprises an ascent assist device having: an actuator into which high-pressure gas is introduced to give the bed an ascending force; and a switch for turning the actuator ON/OFF.

With the above stretcher, when the switch is turned ON in lifting up the bed after a sick or injured person is laid on the bed, the actuator drives. As a result, an ascending force is exerted on the bed by high-pressure gas introduced in the actuator. Therefore, in the bed lifting work, ambulance officers can utilize a large force resulting from high-pressure gas, thereby extensively reducing the physical burdens

on the ambulance officers. Further, even an ambulance officer with less muscle can smoothly do the bed lifting work. As a result, the ambulance officers can be prevented from straining their body parts.

Still another stretcher of the present invention is a stretcher including a bed on which a sick or injured person will be laid, legs foldably provided on the bed and configured to raise the bed by deploying from the bed, and casters provided at the legs, respectively, and the stretcher further comprises an ascent assist device having: an actuator into which high-pressure gas is introduced to give the legs forces toward deployment; and a switch for turning the actuator ON/OFF.

Also with the above stretcher, when the switch is turned ON in lifting up the bed after a sick or injured person is laid on the bed, the actuator drives. As a result, forces toward deploying the legs are exerted on the legs by high-pressure gas introduced in the actuator, and an ascending force is exerted on the bed with the deployment of the legs. Therefore, in the bed lifting work, ambulance officers can utilize a large force resulting from high-pressure gas, thereby extensively reducing the physical burdens on the ambulance officers. Further, even an ambulance officer with less muscle can smoothly do the bed lifting work.

The stretcher preferably further comprises a tank for storing high-pressure gas and a gas pipe line for connecting the tank and the actuator.

Note that the pipe used in the gas pipe line herein referred to is not limited to a rigid pipe but may be a flexible pipe such as hose or tube.

Since the above stretcher is equipped with a tank for storing high-pressure gas, there is no need to bring a gas source (such as a gas container) for supplying high-pressure gas into the actuator to the site of the bed lifting work, in addition to the stretcher. Therefore, the convenience of the stretcher can be enhanced.

The actuator may be a pneumatic cylinder and the switch may be a switch for opening and closing the flow path of the gas pipe line.

Thus, the actuator and the switch can have relatively simple structures. The pneumatic cylinder is not limited to one using air as working fluid but may be one using another gas, such as oxygen or nitrogen, as working fluid.

It is preferable that the pneumatic cylinder has a cylinder body and a piston which divides the inner space of the cylinder body into a pressure chamber and a vented chamber and the stretcher further comprises a speed controller for controlling the speed of gas exhausted from the vented chamber.

When high-pressure gas is introduced into the pressure chamber of the pneumatic cylinder, the speed of gas exhausted from the vented chamber is controlled to control the moving speed of the piston. Thus, the ascending speed of the bed can be controlled depending on the lifting work of ambulance officers, thereby providing a smoother lifting work. In addition, an abrupt ascent of the bed can be prevented, which reduces the physical burden on the sick or injured person.

The gas pipe line may be provided with a speed controller for controlling the speed of high-pressure gas flowing from the tank into the pneumatic cylinder.

Thus, the ascending speed of the bed can be controlled depending on the lifting work of ambulance officers, thereby providing a smoother lifting work. In addition, an abrupt ascent of the bed can be prevented, which reduces the physical burden on the sick or injured person.

By the way, a normal ambulance vehicle is loaded with a gas source filled with high-pressure gas, such as a gas container for giving sick or injured persons oxygen.

Therefore, the stretcher is preferably formed with a gas inlet through which high-pressure gas is introduced into the tank from a gas source placed in an ambulance vehicle.

Preferably, before a sick or injured person is carried on the stretcher, the gas inlet is connected to the gas source in an ambulance vehicle and the tank is charged

with high-pressure gas from the gas source. It is a matter of course that means for flowing gas therethrough, such as a pipe or a tube, may be used for the connection between the gas inlet and the gas source. In other words, the tank may be connected directly or indirectly to the gas source.

Therefore, a gas container or an air tank placed on the ambulance vehicle can be used as a gas source for supplying high-pressure gas into the tank for the stretcher. Hence, there is no need to always carry on the ambulance vehicle a dedicated gas source for supplying gas into the tank. Further, the work of filling the tank with gas can be done in advance in the ambulance vehicle. Therefore, ambulance work can be smoothly done. In addition, the convenience of the stretcher can be enhanced.

Still another stretcher of the present invention is a stretcher including a bed on which a sick or injured person will be laid, legs foldably provided on the bed and casters provided at the legs, respectively, and the stretcher further comprises an ascent assist device having: a lifting mechanism for giving the bed an ascending force; a switch for turning the lifting mechanism ON/OFF; and a speed control means for controlling the speed of the bed raised by the lifting mechanism.

With the above stretcher, when the switch is turned ON in lifting up the bed after a sick or injured person is laid on the bed, the lifting mechanism operates. As a result, an ascending force is exerted on the bed. Therefore, in the bed lifting work, the physical burdens on the ambulance officers can be reduced and even an ambulance officer with less muscle can smoothly do the lifting work. Further, since the stretcher comprises the speed control means for controlling the ascending speed of the bed, the ascending speed of the bed can be controlled depending on the lifting work of the ambulance officers, thereby providing a smoother lifting work. In addition, since an abrupt ascent of the bed can be prevented, this lessens the shock of the sick or injured person laid on the bed and thereby reduces his physical burden.

Each of the above stretchers preferably comprises a speed control means for

controlling the descending speed of the bed when the raised bed is lowered.

Thus, the descending speed of the bed can be controlled, which allows the bed to be lowered smoothly. Therefore, the workload for the ambulance officers and the stress on the sick or injured person can be reduced. Further, since an abrupt descent of the bed can be prevented, the shock on the stretcher can be reduced. Therefore, the life of the stretcher can be extended.

Each of the above stretchers preferably comprises a deactivation means for deactivating the ascent assist device.

Using the deactivation means, the ascent assist device can be freely deactivated at any time. For example, in the event of failure of the ascent assist device, the bed can be raised by manual lifting-up work alone as the result of deactivation of the ascent assist device. Also, the bed can be lowered by manual pulling-down work alone. Therefore, it can be avoided that the ascent and descent of the bed are prevented due to failure of the ascent assist device, which enhances the reliability of the stretcher.

Still another stretcher of the present invention is a stretcher including a bed on which a sick or injured person will be laid, legs foldably provided on the bed to deploy with ascent of the bed and fold with descent of the bed, and casters provided at the legs, respectively, and the stretcher further comprises an initial ascent assist device for giving the bed an ascending force in an initial stage of a lifting work during which the bed is raised from the lowest level to a predetermined halfway level between the lowest and highest levels of the bed.

With the above stretcher, the initial ascent assist device gives the bed a large ascending force in the initial stage of a lifting work in which the ambulance officers are less likely to exhibit their potentials, which considerably reduces the physical burdens of the ambulance officers. Therefore, the ambulance officers can easily lift up the bed. In addition, the possibility can be reduced that the ambulance officers may

strain their bodies. For this stretcher, after the bed is raised up to the halfway level, the assist function of the initial ascent assist device is eliminated. Since, even then, the ambulance officers can take their postures with which they can easily exhibit their strengths, they can smoothly implement the subsequent lifting work.

The initial ascent assist device may comprise: an actuator into which high-pressure gas is introduced to give the bed an ascending force; and a switch for turning the actuator ON/OFF.

The actuator may be a pneumatic cylinder.

Thus, an initial ascent assist device exhibiting a quite large force can be obtained.

The initial ascent assist device may comprise: a hydraulic actuator for giving the bed an ascending force; and a switch for turning the actuator ON/OFF.

The initial ascent assist device may comprise: a motor-driven actuator for giving the bed an ascending force; and a switch for turning the actuator ON/OFF.

The initial ascent assist device may comprise: a treadle lever pivotally mounted on the bed to angularly move through the depression by foot; and a link mechanism for converting a force of angular movement of the treadle lever to a force to raise the bed.

When the ambulance officer depresses the treadle lever, he can raise the bed up to the halfway level without stooping to lift up the bed. Therefore, the bed can be easily raised in the initial stage of the lifting work.

The above stretcher preferably further comprises a main ascent assist device for giving the bed an ascending force in a later stage of the lifting work during which the bed is raised from the halfway level to the highest level or over all the stages of the lifting work during which the bed is raised from the lowest level to the highest level.

With this structure, the physical burden of the bed lifting work can be reduced

not only in the initial stage of the lifting work but also in the later stage thereof or over all the stages thereof. If the main ascent assist device is activated over all the stages of the lifting work, the ascending force from the initial ascent assist device can be reduced to a small extent. This allows size reduction or weight reduction of the initial ascent assist device.

The main ascent assist device may be a device for giving the bed an ascending force by giving the legs forces toward deployment.

In the stretcher for assisting the ascent of the bed by giving the legs forces toward deployment, the load required for the deployment of the legs is highest in the initial stage of the deployment and gradually decreases with the progress of the deployment. Therefore, the need to assist the ascent of the bed in the initial stage is higher than in other types of stretchers. If the stretcher is equipped with the initial ascent assist device, the deployment of the legs in the initial stage can be implemented easily.

The main ascent assist device may comprise: a main actuator into which high-pressure gas is introduced to give the bed an ascending force; and a switch for turning the main actuator ON/OFF.

Thus, the ascent of the bed can be assisted using a large force resulting from high-pressure gas.

Still another stretcher of the present invention is a stretcher which includes a bed on which a sick or injured person will be laid, legs foldably provided on the bed to deploy with ascent of the bed and fold with descent of the bed, and casters provided at the legs, respectively, and is configured to be laid on a support platform with the legs folded up by pushing the legs against the support platform as the legs deploy, and the stretcher further comprises: a deployment force application mechanism for giving the legs forces toward deployment; and a deactivation mechanism for deactivating the deployment force application mechanism when the length of part of the stretcher laid

on the support platform exceeds a predetermined length. Examples of the support platform herein referred to include platforms installed on the floors of ambulance vehicles, such as a vibration isolation platform, floors (rear decks) of ambulance cars, and platforms installed at sites other than the ambulance vehicles, such as hospitals.

With the above stretcher, when it is laid on the support platform, the deployment force application mechanism gives the legs forces toward deployment so that the bed is given an ascending force. Therefore, the force required for ambulance officers to keep the raised position of the bed is reduced, which reduces the physical burdens of the ambulance officers. Further, since the deployment force application mechanism gives the bed an ascending force even if the locking mechanism for the legs are released, the ambulance officers are less likely to experience a shock. Therefore, the ambulance officers are less likely to strain their bodies.

If the legs are kept deployed, the stretcher cannot be laid on the support platform. With the above stretcher, however, the deactivation mechanism deactivates the deployment force application mechanism when the length of part of the stretcher laid on the support platform exceeds the predetermined length. Thus, the legs can be easily folded up. As a result, the stretcher can be easily laid on the support platform. Therefore, according to this aspect of the present invention, the physical burdens of ambulance officers can be reduced.

The deployment force application mechanism may comprise a pneumatic cylinder, and the deactivation mechanism may comprise a gas release mechanism for releasing high-pressure gas in the pneumatic cylinder.

With this structure, the physical burden of the ambulance officers carry-in work can be reduced using the pressure of high-pressure gas.

Still another stretcher of the present invention is a stretcher which includes a bed on which a sick or injured person will be laid, front and rear legs foldably provided at the front and rear sides of the bed, and casters provided at the front and

rear legs, respectively, and is configured to be laid on a support platform from the front side of the bed with the front and rear legs folded up by pushing the legs against the support platform as the front and rear legs deploy, and the stretcher further comprises: a deployment force application mechanism for giving at least the rear legs forces toward deployment; and a deactivation mechanism for releasing the forces toward deployment given to the rear legs from the deployment force application mechanism when the length of part of the stretcher laid on the support platform exceeds a predetermined length.

Also with the above stretcher, the physical burdens of ambulance officers can be reduced for the reasons mentioned already. Further, the ambulance officers are less likely to strain their bodies.

The bed may include a rail extending in a longitudinal direction of the bed, at least the front legs may be provided with a slider for sliding on the rail according to the deployment and folding of said at least front legs, and the deactivation mechanism may comprise a position sensor for detecting whether the slider passes through a predetermined position on the rail and may be configured to deactivate the deployment force application mechanism when the slider passes through the predetermined position.

With the above structure, when the slider passes through the predetermined position, it is detected that the length of part of the stretcher laid on the support platform has reached a predetermined length. As a result, the deployment force application mechanism is deactivated. Therefore, the deployment force application mechanism can be automatically deactivated with a simple structure.

The above stretcher may further comprise a locking mechanism for locking the front and rear legs in deploying positions such that the locking can be released in laying the stretcher onto the support platform, wherein the deployment force application mechanism comprises a pneumatic cylinder and the deactivation

mechanism comprises a gas release mechanism for releasing high-pressure gas in the pneumatic cylinder when the slider passes through the predetermined position.

With this structure, the physical burden of the ambulance officers carry-in work can be reduced using the pressure of high-pressure gas.

A stretcher system of the present invention comprises: any one of the above-mentioned stretchers; a support platform on which the stretcher is laid, wherein the support platform is provided with a conveyer for conveying the stretcher onto the support platform.

With the above stretcher system, the stretcher is automatically conveyed onto the support platform in laying the stretcher on the support platform. Therefore, not only the force to keep the raised position of the bed can be reduced but also the force to push in the stretcher to the top of the support platform can be reduced. As a result, the physical burdens of ambulance officers can be further reduced.

Brief Description of the Drawings

Figure **1** is a side view of a stretcher according to Embodiment 1 with the legs deployed.

Figure **2** is a side view of the same stretcher with the legs folded up.

Figure **3** is a plan view, partly broken away, of the same stretcher with the legs folded up.

Figure **4** is a piping diagram of the same stretcher.

Figure **5** is a schematic diagram showing how the stretcher is connected to an oxygen container in an ambulance vehicle.

Figure **6** is a gas piping diagram according to a variant.

Figure **7** is a plan view, partly broken away, of a stretcher according to Embodiment **2**.

Figure **8** is a piping diagram of the same stretcher.

Figure **9** is a side view of a stretcher according to a modification.

Figure **10** is a side view of a stretcher according to another modification.

Figure **11** is a side view of a stretcher according to Embodiment 3.

Figure **12** is a side view of the same stretcher.

Figure **13** is a side view of a stretcher according to Embodiment 4.

Figure **14** is a side view of a stretcher according to Embodiment 5.

Figure **15** is a side view of a stretcher according to Embodiment 6.

Figure **16** is a side view of a stretcher according to Embodiment 7.

Figure **17** is a side view of a stretcher according to Embodiment 8.

Figure **18** is a side view of the same stretcher.

Figure **19** is a side view of a stretcher according to Embodiment 9.

Figure **20** is a piping diagram of the same stretcher.

Figure **21** is a graph showing the relation between bed level and required physical burden.

Figure **22** is a piping diagram of a stretcher according to Embodiment 10.

Figure **23** is a side view of the same stretcher when carried in.

Figure **24** is a diagram for illustrating the carrying-in of the same stretcher.

Figure **25** is a diagram for illustrating the carrying-in of the same stretcher.

Figure **26** is a diagram for illustrating the carrying-in of the same stretcher.

Figure **27** is a diagram for illustrating the carrying-in of the same stretcher.

Figure **28** is a diagram for illustrating the carrying-in of the same stretcher.

Figure **29** is a side view of a hook carriage.

Figure **30** is a side view of the hook carriage.

Figure **31** is a side view of the hook carriage.

Best Mode for Carrying out the Invention

Embodiments of the present invention will be described below with reference

to the drawings.

Embodiment 1

As shown in Figure **1**, a stretcher **1** of Embodiment 1 comprises a bed **21** on which a sick or injured person will be laid, and legs **22** foldably provided on the bed **21**. Hereinafter, the side of the stretcher at which the head of a sick or injured person laid thereon comes (right side in Figures **1** to **3**) is referred to as the head side while the other side at which the feet of the sick or injured person comes (left side in Figures **1** to **3**) is referred to as the feet side.

The bed **21** is made up of a so-called framed structure and is formed by assembling a plurality of pipe members. The bed **21** supports, at some points on the structure of the pipe members, a litter (not shown) for riding a sick or injured person thereon. In this embodiment, the bed **21** is formed separately from the litter. It is a matter of course that the bed **21** may be equipped with a litter. In other words, the bed **21** may be formed integrally with the litter.

The legs **22** consist of two front legs **24** and two rear legs **25**. The front legs **24** are legs provided at the head side of the stretcher and are each composed of a main leg **24a** and a sub leg **24b** pivotally connected halfway to the main leg **24a**. Each main leg **24a** is provided at its distal end with a caster **23**. The rear legs **25** are legs provided at the feet side of the stretcher and are each composed of a main leg **25a** and a sub leg **25b** pivotally connected halfway to the main leg **25a**. Each main leg **25a** is also provided at its distal end with a caster **23**.

The root ends of the main legs **25a** are pivotally supported to the bed **21**. On the other hand, the root ends of the sub legs **25b** of the rear legs **25**, the root ends of the main legs **24a** of the front legs **24** and the root ends of the sub legs **24b** of the front legs **24** are pivotally supported to sliders **31**, **32** and **33**, respectively. The bed **21** is formed with a longitudinally extending rail **27**. The sliders **31**, **32** and **33** are

slidably mounted to the rail **27** (wherein the slider **33** is locked to a fixed point of the bed while the bed **21** is being raised and lowered).

According to the above structure, when the bed **21** is raised, the sliders **31** and **32** move to the head side so that the legs **22** deploy. On the other hand, when the bed **21** is lowered, the sliders **31** and **32** move to the feet side so that the legs **22** are folded. In other words, the bed **21** ascends with deployment of the legs **22**, while the bed **21** descends with the folding of the legs **22**.

The stretcher **1** is provided with a locking mechanism (not shown) for the legs **22**. When the bed **21** ascends to a predetermined level so that the deployment of the legs **22** is completed, the legs **22** are automatically locked. The head and feet sides of the bed **21** are provided with unlocking levers **35a** and **35b** (see Figure **3**), respectively, for releasing the locking mechanism. When the unlocking levers **35a**, **35b** are pulled, the locking mechanism is released to allow the folding of the legs **22** (in other words, the descent of the bed **21**).

On the bottom of the bed **21**, a pair of head-side right and left pneumatic cylinders **8** and a pair of feet-side right and left pneumatic cylinders **9** are mounted. Each of these pneumatic cylinders **8** and **9** consists of a cylindrical body **30** and a piston rod **28** inserted in the body **30**. The inner space of the body **30** is divided into a pressure chamber **51** and a vented chamber **52** by the piston rod **28** (see Figure **4**). Each pneumatic cylinder **8**, **9** in the present embodiment is configured so that high-pressure gas is introduced into the pressure chamber **51** of the cylinder body **30** and the pressure of the high-pressure gas is used to allow the piston rod **28** to produce a retraction force.

Each pneumatic cylinder **8**, **9** is placed substantially in parallel with the longitudinal direction of the bed **21**. A cylinder fitting **4** is provided to the distal end of the body **30** of the pneumatic cylinder **8**. The piston rods **28** of the head-side pneumatic cylinders **8** are secured to the slider **32** through drawing blocks **5** and

drawing plates **6**, respectively. Thus, the slider **32** slides backward and forward (to the left and right in Figures **1** to **3**) according to the extension and retraction, respectively, of the piston rod **28**. On the other hand, the piston rods **28** of the feet-side pneumatic cylinders **9** are secured to the slider **31** through drawing plates **7**, respectively. Thus, the slider **31** slides backward and forward according to the extension and retraction, respectively, of the piston rod **28**.

A tank **10** for storing high-pressure gas is attached at the feet side of the bed **21**. The tank **10** is formed with a gas inlet **34** through which high-pressure gas is externally introduced. The gas inlet **34** is provided with an opening/closing means **40** such as a check valve or a shut-off valve (see Figure **4** but not given in Figures **1** to **3**), and is configured to be able to open and close with the help of the opening/closing means **40**. The tank **10** is connected to the individual pneumatic cylinders **8** and **9** through corresponding gas pipe lines (not given in Figures **1** to **3**). Thus, with this stretcher **1**, high-pressure gas is supplied from the attached tank **10** to each of the pneumatic cylinders **8** and **9**.

There is no limit on the shape, size and attached position of the tank **10**. The tank **10** need only have a capacity enough to be able to operate the pneumatic cylinders **8** and **9** at least once. Alternatively, in order to allow for a reattempt to lift up the bed and concurrently achieve size reduction of the tank **10**, the tank **10** may have a capacity enough to be able to operate the pneumatic cylinders **8** and **9** a few times. Further, there is also no limit on the piping arrangement of the gas pipe lines. The gas pipe line may be constituted by stainless pipes, aluminum pipes, iron pipes or pipes made of other kinds of metals or may be constituted by flexible pipes. The gas pipe line can be constituted by pressure-tight hoses or tubes.

Figure **4** shows a piping diagram for high-pressure gas. The piping system **50** is composed of a head-side piping system **41** for controlling the head-side pneumatic cylinders **8** and a feet-side piping system **42** for controlling the feet-side pneumatic

cylinders **9**.

The head-side piping system **41** has an intake pipe **43** for leading high-pressure gas thereinto from the tank **10**, two branch pipes **44** branched from the intake pipe **43** and then connected to the pressure chambers **51** of the pneumatic cylinders **8**, a release pipe **45** for communicating the vented chambers **52** of the pneumatic cylinders **8** with the outside, and an exhaust pipe **46** for exhausting high-pressure gas in the pressure chambers **51** of the pneumatic cylinders **8** to the outside. The intake pipe **43** is equipped with, in the order away from the tank **10**, an intake switch **11** formed of a mechanical valve and a speed controller (speed control valve) **47**. One end of the exhaust pipe **46** is connected between the intake switch **11** and the speed controller **47** in the intake pipe **43**, while the other end is open to the outside. The exhaust pipe **46** is equipped with an exhaust switch **12** formed of a mechanical valve and a speed controller **48**.

The feet-side piping system **42** has the same structure as the head-side piping system **41**. An intake pipe **43** of the feet-side piping system **42** is also equipped with an intake switch **13** and a speed controller **47**. An exhaust pipe **46** of the feet-side piping system **42** is also equipped with an exhaust switch **14** and a speed controller **48**.

The piping system **50** including the pneumatic cylinders **8** and **9**, the intake switches **11** and **13** and the speed controllers **47** constitutes an ascent assist device for assisting the ascent of the bed **21**. The speed controller **47** in the intake pipe **43** constitutes a speed control means for controlling the ascending speed of the bed **21**, while the speed controller **47** in the exhaust pipe **46** constitutes a speed control means for controlling the descending speed of the bed **21**.

As shown in Figure **3**, the intake switch **11** and the exhaust switch **12** in the head-side piping system **41** are placed at the front side (i.e., head side) of the bed **21**. The intake switch **11** and the exhaust switch **12** are both push-button switches and are

arranged in positions oriented frontward in consideration of ease of operation of an ambulance officer operating the stretcher **1** from the front. On the other hand, the intake switch **13** and the exhaust switch **14** in the feet-side piping system **42** are placed at the rear side (i.e., feet side) of the bed **21**. The intake switch **13** and the exhaust switch **14** are also push-button switches and are arranged in positions oriented rearward in consideration of ease of operation of an ambulance officer operating the stretcher **1** from the rear.

Note that the intake switches **11** and **13** and the exhaust switches **12** and **14** are not limited to push-button switches but may be other types of switches. For example, rotary switches (such as dial switches) or lever-pulling switches may be used.

Next, the usage and behavior of the stretcher **1** will be described.

In using the stretcher **1**, high-pressure gas can be supplied to the tank **10** on site but, in order to promptly do ambulance work, the tank **10** is preferably filled with high-pressure gas prior to the arrival of an ambulance vehicle at the site. The tank **10** may be filled with high-pressure gas before the stretcher **1** is loaded on an ambulance vehicle. Generally, many ambulance vehicles are loaded with high-pressure gas sources such as oxygen containers for oxygen inhalation or air tanks for storing compressed air. Therefore, in the course of travel of an ambulance vehicle to the site, the tank may be filled with high-pressure gas using a high-pressure gas source placed on the vehicle.

For example, as shown in Figure **5**, an oxygen container **62** placed on an ambulance vehicle **61** may be connected to the gas inlet **34** of the tank **10** of the stretcher **1** through a pressure-tight tube **63** or the like so that high-pressure gas can be supplied from the oxygen container **62** to the tank **10**. It suffices if the pressure of high-pressure gas in the tank **10** is set, for example, at approximately 5 to 10 atmospheres. Therefore, in order to supply a sufficient amount of high-pressure gas to the tank **10**, a normal gas container (with a pressure of about 20 to 30 atmospheres)

will suffice. However, the required pressure for the tank **10** is not limited to the above-described numeric range of atmospheres.

When an ambulance vehicle arrives at the site, an ambulance officer takes the stretcher **1** out of the ambulance vehicle. In doing so, the ambulance officer pulls the feet-side unlocking lever **35b** and draws the stretcher **1** out of the ambulance vehicle while pushing the intake switch **13**. As a result, in the feet-side piping system **42** of the gas piping system **50**, high-pressure gas is introduced from the tank **10** through the intake switch **13** to the pressure chambers **51** of the pneumatic cylinders **9**. Thus, the rear legs **25** are deployed. The front legs **24** automatically deploy by self-weight when the stretcher **1** is taken out. In this manner, the stretcher **1** changes from a position in which the legs **22** are folded (the position shown in Figure **2**) to a position in which the legs **22** are deployed (the position shown in Figure **1**), so that it can travel on the ground. In this state, the ambulance officer or officers roll the stretcher **1** while pushing or pulling it until they move the stretcher **1** to the vicinity of a sick or injured person.

When the stretcher **1** is moved to the vicinity of the sick or injured person, two ambulance officers carry out operations of lowering and raising the bed **21** while they are present to the front and rear, respectively, of the stretcher **1**. In the lowering operation, concurrently with the release of the locking mechanism (not shown) for the legs **22** through the pulling of the unlocking levers **35a** and **35b**, the ambulance officer present to the front of the stretcher **1** pushes the head-side exhaust switch **12** (but does not need to push the exhaust switch **12** if the pneumatic cylinders **8** are not filled with high-pressure gas) and the other ambulance officer present to the rear thereof pushes the feet-side exhaust switch **14**. As a result, the bed **21** is lowered. In other words, the legs **22** are folded up. Then, the sick or injured person is laid on the bed **21**.

In the raising operation, concurrently with the pulling of the unlocking levers

35a and **35b**, the ambulance officer present to the front of the stretcher **1** pushes the head-side intake switch **11** and the other ambulance officer present to the rear thereof pushes the feet-side intake switch **13**. As a result, in the head-side piping system **41** of the gas piping system **50**, high-pressure gas is introduced from the tank **10** through the intake switch **11** and the speed controller **47** to the pressure chambers **51** of the pneumatic cylinders **8**. At the same time, in the feet-side piping system **42**, high-pressure gas is introduced from the tank **10** through the intake switch **13** and the speed controller **47** to the pressure chambers **51** of the pneumatic cylinders **9**.

Concurrently with or after the pushing of the intake switches **11** and **13**, the ambulance officers lift up the bed **21**. At the time, since high-pressure gas is introduced into the pressure chambers **51** of the pneumatic cylinders **8** and **9**, retraction forces are applied to the piston rods **28**. Therefore, the sliders **32** and **31** connected to the piston rods **28** receive forces toward the head side (right side in Figures **2** and **3**) while the legs **22** receive forces toward deployment. As a result, the ambulance officers can lift up the bed **21** with small strengths.

When lifting the bed **21** up to a predetermined level, the ambulance officers release the unlocking levers **35a** and **35b** so that the locking mechanism acts to hold the legs **22** in a deployed position. Thereafter, the ambulance officers carry the stretcher **1** into the ambulance vehicle. In doing so, the ambulance officers push the stretcher **1** from its head side into the ambulance vehicle and then turns the exhaust switch **14** ON while pulling the feet-side unlocking lever **35b**. As a result, the exhaust pipe **46** is open to the atmosphere to discharge high-pressure gas in the pressure chambers **51** of the pneumatic cylinders **9** through the exhaust switch **14** and the speed controller **48** to the outside. During the time, the legs **22** are folded. Therefore, if the stretcher **1** is pushed into the ambulance vehicle concurrently with the folding of the legs **22**, it can be easily carried in the vehicle. The front legs **24** are folded as the result of backward sliding movement of the slider **33** even if high-pressure gas in the

pneumatic cylinders **8** is not exhausted.

As described above, the stretcher **1** has a power assist function for assisting the ambulance officers work of lifting up the bed **21**. According to the present embodiment, while the ambulance officers lift up the bed **21**, the pneumatic cylinders **8** and **9** apply large forces toward deploying the legs **22** to the stretcher **1** so that a large upward force can be given to the bed **21**. Therefore, the physical burdens of the ambulance officers can be extensively reduced. This makes it possible for even an ambulance officer with less muscle to smoothly lift up the bed **21**. In addition, the ambulance officers can reduce their fatigue due to the lifting work and can be prevented from straining their bodies (for example, their backs).

Since the intake pipe **43** is provided with a speed controller **47** to control the speed of high-pressure gas flowing from the tank **10** into the pneumatic cylinders **8** and **9**, this can prevent the legs **22** from abruptly deploying. Therefore, the bed **21** can be raised slowly so that a physical burden due to shock or vibrations is not imposed on the sick or injured person. In addition, the standing speed of the legs **22** can be controlled freely depending on the lifting work of the ambulance officers and the sick or injured person's weight, which provides a more efficient lifting work.

Since the exhaust pipe **46** is provided with a speed controller **48** to control the exhausting speed of high-pressure gas in the pneumatic cylinders **8** and **9**, this can prevent high-pressure gas from being abruptly discharged. Therefore, the convenience of the stretcher **1** can be enhanced without unnecessary shock given to the sick or injured person and ambulance officers at the discharge of high-pressure gas. Further, abrupt descent of the bed **21** can be prevented, which reduces the workloads of the ambulance officers and the sick or injured person's stress. Furthermore, since less shock is applied to the stretcher **1**, this extends the life of the stretcher **1**.

Since pneumatic cylinders **8** and **9** are used as actuators for assisting the work of lifting up the bed **21**, the actuators can be constructed relatively simply. In addition,

since the structure and behavior of the actuators are simple, this provides highly reliable actuators. Further, the actuators can be reduced in weight.

Since the stretcher **1** is equipped with the tank **10** for storing high-pressure gas, this eliminates the need for an additional gas source for supplying high-pressure gas into the pneumatic cylinders **8** and **9**, such as a gas container, which allows free operation of the pneumatic cylinders **8** and **9** at any time at the site where the stretcher **1** has been carried.

In this embodiment, the tank **10** is a non-detachable or fixed type one. The tank **10** of the present invention, however, may be constructed detachably. Further, in this embodiment, the tank **10** is fixed to the bed **21**. The tank **10** of the present invention, however, may be disposed separately from the bed **21** unless it is connected to the pneumatic cylinders **8** and **9** through pipes, tubes or the like.

If the work of filling the tank **10** with high-pressure gas is done inside the ambulance vehicle **61**, this eliminates the need to fill the tank with high-pressure gas prior to the call-out of the ambulance vehicle and also eliminates the need to fill the tank with high-pressure gas after the arrival at the site. Therefore, the ambulance vehicle can be mobilized immediately and ambulance work at the site can be smoothly done. As a result, the convenience of the stretcher **1** can be enhanced.

The high-pressure gas piping system in the stretcher **1** is not limited to the piping system **50** (see Figure **4**) in this embodiment. For example, the speed controllers **47**, which are carried on the intake pipes **43** in this embodiment, may be carried on the release pipes **45** as shown in Figure **6**. In other words, the release pipes **45** may be provided with speed controllers **47** for controlling the speed of high-pressure gas exhausted from the vented chambers **52**, respectively. Also with this structure, the standing speed of the legs **22** can be freely controlled depending on the lifting work of the ambulance officers, which provides the same effects as in the above embodiment.

High-pressure gas used in the stretcher **1** of the above embodiment is not limited to oxygen gas but may be other types of gases such as high-pressure air or nitrogen gas.

The number of pneumatic cylinders **8**, **9** for each of the front and rear leg pairs is not limited to two but may be one, three or more. There is no limit to the total number of pneumatic cylinders **8** and **9**.

The pneumatic cylinders **8** and **9** in the above embodiment are those of the type which their piston rods **28** retract by introducing high-pressure gas therein. Use can of course be made of pneumatic cylinders of the type which their piston rods extend by introducing high-pressure gas therein.

The speed control means for controlling the ascending or descending speed of the bed **21** are not limited to the speed controllers **47** and **48** but may be other types of speed control means, for example, other mechanical or electrical speed control means.

The above stretcher **1** enhances its convenience by virtue of being equipped with the tank **10**. The present invention, however, covers stretchers not equipped with the tank **10**. For example, the gas piping system **50** may be provided with a gas inlet through which high-pressure gas can be directly led from a gas source such as a gas container into the piping system **50**. Such a stretcher can also exhibit a power assist function using high-pressure gas.

In the above embodiment, pneumatic cylinders **8** and **9** are used as actuators. The actuators used in the above embodiment are not limited to pneumatic cylinders and not particularly limited so long as they can lead high-pressure gas therein and use the high-pressure gas to give the bed **21** an ascending force. For example, a pneumatic motor can be used as an actuator.

The actuator may be of a type which raises the bed **21** by giving the legs **22** forces toward deployment like the above embodiment, or may be of a type which gives the bed **21** an ascending force without giving the legs **22** themselves any forces.

For example; an actuator may be adopted which is interposed between the bed **21** and the ground and acts to raise the bed **21** by pushing the ground.

Embodiment 2

Embodiment 2 is a modified form of the stretcher **1** of Embodiment 1, in which the pneumatic cylinders **8** and **9** are turned ON/OFF in conjunction with the unlocking levers. Further, this embodiment further includes a deactivation device for forcedly deactivating the ascent assist device.

As shown in Figure **7**, the stretcher **1** of Embodiment 2 has substantially the same structure as the stretcher **1** of Embodiment 1. Like Embodiment 1, a head-side unlocking lever **35a** is provided at the head side of the bed **21** and a feet-side unlocking lever **35b** is provided at the feet side of the bed **21**. In Embodiment 2, a main switch **70** and a deactivation switch **71** both for the ascent assist device are also provided at the feet side of the bed **21**. The main switch **70** and the deactivation switch **71** are both formed of dial (rotary) switches. The type of the switches **70** and **71**, however, is not particularly limited.

As shown in Figure **8**, the piping system **50** for the stretcher **1** of Embodiment 2 is also made up of a head-side piping system **41** and a feet-side piping system **42**. An intake pipe **43** for leading high-pressure gas therein from the tank **10** is provided with the main switch **70** formed of a mechanical valve. The intake pipe **43** is branched into an intake pipe **43a** in the head-side piping system **41** and an intake pipe **43b** in the feet-side piping system **42**. The intake pipe **43a** is provided with an intake switch **11** for turning ON/OFF in conjunction with the head-side unlocking lever **35a**. On the other hand, the intake pipe **43b** is provided with an intake switch **13** for turning ON/OFF in conjunction with the feet-side unlocking lever **35b**.

Further, the piping system **50** is equipped with an exhaust pipe **46** for releasing high-pressure gas in the system to the atmosphere. One end of the exhaust

pipe **46** is connected to the main switch **70** and the other end is open to the atmosphere. The exhaust pipe **46** is provided, in the order from said one end to the other end, with an exhaust switch **14** formed of a mechanical valve and a speed controller **48**.

The structures of part of the intake pipe **43a** closer to the pneumatic cylinder **8** and part of the intake pipe **43b** closer to the pneumatic cylinder **9** are the same as in Embodiment 1 and therefore the description of them will not be given here.

In this embodiment, the head-side and feet-side intake switches **43a** and **43b** are connected to atmospheric release pipes **73a** and **73b**, respectively. One end of the atmospheric release pipe **73a** is connected to the intake pipe **43a** between the intake switch **11** and the speed controller **47**, while the other end is connected to the deactivation switch **71**. One end of the atmospheric release pipe **73b** is connected to the intake pipe **43b** between the intake switch **13** and the speed controller **47**, while the other end is connected to the deactivation switch **71**. The deactivation switch **71** is a switch for switching atmospheric release back and forth between the atmospheric release pipes **73a** and **73b**, and is constituted by a mechanical valve. However, the structure of the deactivation switch **71** is not particularly limited. The atmospheric release pipes **73a** and **73b** and the deactivation switch **71** constitute a deactivation device **72** for deactivating the ascent assist device.

In the operation of raising the bed **21** in this embodiment, the main switch **70** is first turned ON. Then, the head-side and feet-side ambulance officers pull the head-side and feet-side unlocking levers **35a** and **35b**, respectively. Thus, the intake switches **11** and **13** are turned ON. As a result, high-pressure gas in the tank **10** passes through the intake switches **11** and **13** and the speed controllers **47** and is then introduced into the pressure chambers **51** of the head-side and feet-side pneumatic cylinders **8** and **9**. Thus, the pneumatic cylinders **8** and **9** apply to the legs **22** forces toward deployment so that the bed **21** is given an ascending force. Therefore, the

ambulance officers can easily lift up the bed **21**. After lifting up the bed **21**, the ambulance officers release the unlocking levers **35a** and **35b** to lock the legs **22**.

On the other hand, in carrying the stretcher **1** into the ambulance vehicle, the ambulance officer releases the main switch **70** and then turns the exhaust switch **14** ON. Thereafter, the ambulance officer pulls the unlocking lever **35b**, thereby turning the intake switch **13** ON. As a result, high-pressure gas in the pressure chambers **51** of the pneumatic cylinders **9** passes through the speed controller **47**, the intake switch **13**, the main switch **70**, the exhaust switch **14** and the speed controller **48** and is then exhausted through the exhaust pipe **46** to the outside. Therefore, the ambulance officer can easily fold the legs **22**.

When a failure occurs in the ascent assist device, it is preferable in some cases to deactivate the ascent assist device and implement the ascent of the bed **21** by manual lifting-up work alone. It is also conceivable that when a failure occurs in the ascent assist device, the legs **22** remain receiving forces toward deployment so that they become difficult to fold easily. For example, when a failure occurs in the intake switch **13** after the legs **22** are deployed, high-pressure gas cannot be vented from the pressure chambers **51** of the pneumatic cylinders **9**. If such circumstances are left as they are, this makes it difficult to carry the bed **21** into the ambulance vehicle.

To cope with this, in this embodiment, a deactivation mechanism **72** for forcedly deactivating the ascent assist device is provided. Specifically, the intake pipes **43a** and **43b** are connected to atmospheric release pipes **73a** and **73b**, respectively, which have a common deactivation switch **71**.

In this embodiment, if something wrong happens to the piping system **50**, the ambulance officer turns the deactivation switch **71** ON to forcedly release high-pressure gas in the pneumatic cylinders **8** and **9** to the atmosphere through the atmospheric release pipes **73a** and **73b**. Thus, the high-pressure part of the piping system **50** is open to the outside and the ascent assist device is forcedly deactivated.

Therefore, there is no possibility that at the failure, the ascent assist device prevents the ambulance officers work. Hence, if anything goes wrong, the ambulance officers can deploy and fold the legs **22** by manual labor alone. This improves the reliability of ambulance work.

Also in this embodiment, the ascending and descending speeds of the bed **21** can be controlled by the speed controllers **47** and **48**, which provides the same effects as in Embodiment 1.

In each of the above embodiments, the ascent assist device is a device that includes the pneumatic cylinders **8** and **9** and gives the bed **21** an ascending force with the use of high-pressure gas. As described already, the ascent assist device provides an advantage of effective utilization of a gas container in the ambulance vehicle. The ascent assist device in the present invention, however, need only be one for giving the bed a sufficient ascending force and is not limited to the device using high-pressure gas.

For example, as shown in Figure **9**, an oil-hydraulic ascent assist device may be used. The ascent assist device of this type includes an oil-hydraulic pump **55** instead of the tank **10** for storing high-pressure gas and also includes oil-hydraulic cylinders **58** and **59** instead of pneumatic cylinders **8** and **9**. At the head side of the bed **21**, a head-side switch **56** is provided fro turning ON/OFF the head-side oil-hydraulic cylinders **58**. At the feet side of the bed **21**, a feet-side switch **57** is provided for turning ON/OFF the feet-side oil-hydraulic cylinders **59**. With this stretcher **1**, oil-hydraulic pressure can be used to give the legs **22** forces toward deployment, which allows easy lift-up of the bed **21**.

Alternatively, as shown in Figure **10**, a motor-driven ascent assist device may by used. The ascent assist device of this type includes a battery **65** instead of the tank **10** for storing high-pressure gas and also includes motor-driven actuators **68** and **69**

instead of pneumatic cylinders **8** and **9**. At the head side of the bed **21**, a head-side switch **66** is provided for turning ON/OFF the head-side motor-driven actuators **68**. At the feet side of the bed **21**, a feet-side switch **67** is provided for turning ON/OFF the feet-side motor-driven actuators **69**. With this stretcher **1**, the motor-driven actuators **68** and **69** can give the legs **22** forces toward deployment, which allows easy lift-up of the bed **21**.

Also for each of the above-described ascent assist devices, it is preferable to provide one or both of the speed control means for controlling the ascending speed of the bed **21** and the speed control means for controlling the descending speed of the bed **21**. For the ascent assist device using oil-hydraulic pressure, a speed controller in the oil-hydraulic circuit can be preferably used as a speed control means. For the motor-driven ascent assist device, a motor-operated controller can be used as a speed control means. However, the configuration of the speed control means is not particularly limited and various types of controllers can be used as speed control means.

When each of the above ascent assist devices is provided, it is preferable that the ascent assist device is equipped with a deactivation device for forcedly deactivating the ascent assist device. Thus, if anything is wrong with the ascent assist device, the ascent and descent of the bed **21** can be implemented by manual labor alone as the result of deactivation of the ascent assist device.

Embodiment 3

As shown in Figures **11** and **12**, a stretcher **1** of Embodiment 3 includes a bed **21** on which a sick or injured person will be laid, and legs **22** foldably mounted to the bed **21**. Hereinafter, only different elements from Embodiment 1 will be described. The same elements as in Embodiment 1 are indicated by the same reference numerals and description is not given to them.

In these figures, the reference numeral **80** denotes a caster cover **80** attached to the distal end of each of the main legs **24a** and **25a** of the front and rear legs **24** and **25** to hold the caster **23** rollably. The caster cover **80** is formed with a projection **81** extending sideways (in the front to back direction of the paper in Figures **1** and **2**).

The stretcher **1** of Embodiment 3 does not have the pneumatic cylinders **8** and **9** as described earlier. This stretcher **1** has a pneumatic cylinder **83** mounted at the head side of the bed **21** and a pneumatic cylinder **84** mounted at the feet side of the bed **21**. Each pneumatic cylinder **83**, **84** is oriented downward so that its piston rod **85**, **86** (see Figure **12**) can move up and down.

The distal end of the piston rod **85** of the head-side pneumatic cylinder **83** is connected to one end of a connecting plate **87**. The other end of the connecting plate **87** is pivotally mounted to a support plate **88** fixed to the bed **21**. An abutment **89** is attached halfway through the connecting plate **87**. The connecting plate **87** is disposed above the projection **81** of the associated head-side caster cover **80** and the abutment **89** comes into contact with the projection **81**. As shown in Figure **11**, when the piston rod **85** of the pneumatic cylinder **83** retracts, the connecting plate **87** takes a substantially horizontal position. On the other hand, when the piston rod **85** extends as shown in Figure **12**, the connecting plate **87** takes a position inclined downward toward the front. At this time, the abutment **89** of the connecting plate **87** pushes the projection **81** of the associated caster cover **80** downward, thereby giving the front legs **24** forces toward deployment.

The distal end of the piston rod **86** of the feet-side pneumatic cylinder **84** comes into contact with the projection **81** of the associated feet-side caster cover **80**. When the piston rod **86** extends as shown in Figure **12**, the projection **81** of the associated caster cover **80** is pushed downward. As a result, the rear legs **25** are given forces toward deployment.

Thus, in this embodiment, these pneumatic cylinders **83** and **84** constitute an

initial ascent assist device for assisting the ascent of the bed **21** in the initial stage of the work of lifting up the bed **21**, i.e., in the stage in which the bed **21** is raised from its lowest level to predetermined halfway level. The term halfway level as herein referred to means an arbitrary level between the lowest level (the level when the legs **22** are completely folded) and the highest level (the level when the legs **22** are completely deployed), and does not exactly mean the middle level between them. In this embodiment, the halfway level depends on the amount of extension of the piston rods **85** and **86** of the pneumatic cylinders **83** and **84**. Conversely, the halfway level can be arbitrarily selected by controlling the mounting positions of the pneumatic cylinders **83** and **84** and the amount of extension of the piston rods **85** and **86**.

The halfway level is preferably a level that the ambulance officers can easily exert some great strength. For example, the height of the waist of the ambulance officer can be set as the halfway level. In addition, the halfway level is preferably a level on and above which the ambulance officers will be less likely to strain their bodies (particularly their backs) when lifting up the bed **21**.

The head side of the bed **21** is provided with, as switches for turning the pneumatic cylinder **83** ON/OFF, an intake switch **11** for supplying high-pressure gas to the pneumatic cylinder **83** and an exhaust switch (not shown) for exhausting high-pressure gas in the pneumatic cylinder **83**. The intake switch **11** and the exhaust switch are both push-button switches and placed in positions where the buttons are oriented to the front to allow the ambulance officer to easily operate them from the front.

On the other hand, the feet side of the bed **21** is provided with, as switches for turning the pneumatic cylinder **84** ON/OFF, an intake switch **13** for supplying high-pressure gas to the pneumatic cylinder **84** and an exhaust switch (not shown) for exhausting high-pressure gas in the pneumatic cylinder **84**. The intake switch **13** and the exhaust switch are also push-button switches and placed in positions where the

buttons are oriented to the rear to allow the ambulance officer to easily operate them from the rear.

Note that the switches for turning the pneumatic cylinders **83** and **84** ON/OFF are not limited to the above and various types of switches can be substituted for the above. For example, rotary switches (such as dial switches) or lever-pulling switches may be used. Further, the ON/OFF operation of the pneumatic cylinders **83**, **84** may be associated with an unlocking lever or an unlocking lever may double as a switch for the pneumatic cylinders **83**, **84**.

Though not shown in the figures, the stretcher **1** may be equipped with a high-pressure gas source for supplying high-pressure gas to the pneumatic cylinders **83** and **84**. For example, a gas tank for storing high-pressure gas may be installed on the bed **21**. In this case, the stretcher **1** may be provided with gas pipes that connect the gas tank to the pneumatic cylinders **83** and **84**.

Alternatively, at the ambulance work site, the pneumatic cylinders **83** and **84** may be connected to an external gas source (such as a gas container) and supplied from it with high-pressure gas. In this case, the stretcher **1** is preferably provided with a gas inlet through which high-pressure gas is introduced from the gas source into the pneumatic cylinders **83** and **84**. However, high-pressure gas can of course be introduced directly into the pneumatic cylinders **83** and **84**.

Next, the usage of the stretcher **1** will be described.

The stretcher **1** is previously on board an ambulance vehicle. When the ambulance vehicle arrives at the site, an ambulance officer takes the stretcher **1** out of the vehicle. In dosing so, the ambulance officer pulls the feet-side unlocking lever and draws the stretcher **1** out of the ambulance vehicle. As a result, the stretcher **1** changes from a position in which the legs **22** are folded to a position in which the legs **22** deploy, so that it can travel on the ground. In this state, the ambulance officer or officers roll the stretcher **1** while pushing or pulling it until they move the stretcher **1**

to the vicinity of a sick or injured person.

When the stretcher **1** is moved to the vicinity of the sick or injured person, two ambulance officers carry out operations of lowering and raising the bed **21** while they are present to the front and rear, respectively, of the stretcher **1**. In the lowering operation, concurrently with the release of the locking mechanism (not shown) for the legs **22** through the pulling of the unlocking levers, the ambulance officers lower the bed **21**. As a result, the legs **22** are folded up. Then, the sick or injured person is laid on the bed **21**.

In the raising operation, concurrently with the pulling of the unlocking levers, the ambulance officer present to the front of the stretcher **1** pushes the head-side intake switch **11** and the other ambulance officer present to the rear thereof pushes the feet-side intake switch **13**. As a result, high-pressure gas is introduced into the pneumatic cylinders **83** and **84**, thereby giving the front and rear legs **24** and **25** forces toward deployment.

Concurrently with or after the pushing of the intake switches **11** and **13**, the ambulance officers lift the bed **21** up to the halfway level (in the initial stage of the lifting work). At the time, since the pneumatic cylinders **83** and **84** give the front and rear legs **24** and **25** forces toward deployment, the ambulance officers can lift up the bed **21** with small strengths. If the pressure of high-pressure gas introduced into the pneumatic cylinders **83** and **84** is increased, the bed **21** can be raised up to the halfway level without the need for the ambulance officers to lift up the bed **21**. In other words, the ascent up to the halfway level can be fully automated.

After the bed **21** is lifted up to the halfway level, the bed **21** is raised up to the highest level by further lifting up the bed **21** (in the later stage of the lifting work). As a result, the legs **22** becomes deployed. When the unlocking levers are released in this state, the locking mechanism acts so that the legs **22** are held deployed. Thereafter, the ambulance officers carry the stretcher **1** into the ambulance vehicle.

As described above, the stretcher **1** has a power assist function for assisting the ambulance officers in lifting up the bed **21** in the initial stage of the lifting work. Specifically, while the ambulance officers lift up the bed **21**, the pneumatic cylinders **83** and **84** apply large forces toward deploying the legs **22** to the stretcher **1** so that large upward forces can be given to the bed **21**. Therefore, the physical burdens of the ambulance officers can be extensively reduced in the initial stage where they are forced to stoop to do the lifting work. This makes it possible for even an ambulance officer with less muscle to smoothly lift up the bed **21**. In addition, the ambulance officers can reduce their fatigue due to the lifting work and can be prevented from straining their bodies (for example, their backs).

Since pneumatic cylinders **83** and **84** are used as an initial ascent assist device, the initial ascent assist device can be constructed relatively simply. In addition, since the structure and behavior of the device are simple, this provides a highly reliable initial ascent assist device.

If the stretcher **1** is equipped with a gas source for storing high-pressure gas (such as a gas tank), this eliminates the need for an additional gas source, which allows free operation of the pneumatic cylinders **83** and **84** at any time at the site where the stretcher **1** has been carried.

The type of high-pressure gas used in the stretcher **1** is not particularly limited. For example, oxygen gas, high-pressure air or nitrogen gas can be suitably used.

The number of pneumatic cylinders for each of the head and feet sides is not limited to one but may be two or more.

In the above embodiment, pneumatic cylinders **83** and **84** are used as an initial ascent assist device. The device used in the above embodiment may be of other types which can lead high-pressure gas therein and give the bed **21** an ascending force using the high-pressure gas. For example, pneumatic motors can be used as an initial ascent assist device.

The initial ascent assist device in this invention may be of a type which raises the bed **21** by giving the legs **22** forces toward deployment or may be of a type which raises the bed **21** without giving the legs **22** themselves any forces. For example, an initial ascent assist device may be adopted which is interposed between the bed **21** and the ground and acts to raise the bed **21** by pushing the ground.

If the bed **21** is abruptly raised, the sick or injured person laid on the bed **21** is likely subjected to a shock. To avoid this, the initial ascent assist device may be provided with a speed control means for controlling the ascending speed of the bed **21**. For example, a speed controller (speed control valve) may be disposed in the high-pressure gas piping system for the pneumatic cylinders **83** and **84**. This reduces the sick or injured person's stress.

Embodiment 4

As shown in Figure **13**, the stretcher **1** of Embodiment 4 includes as an initial ascent assist device pneumatic cylinders **93** and **94** with a built-in manual pump, instead of pneumatic cylinders **83** and **84** in Embodiment 3.

The head-side pneumatic cylinder **93** is provided with a boosting lever **97**. The boosting lever **97** extends frontward beyond the bed **21**. Thus, the ambulance officer present to the head side can operate the boosting lever **97** by foot (i.e., manipulate the boosting lever **97** by stepping on it by foot). Therefore, the pressure in the cylinder can be easily raised to easily extend the piston rod **95**.

The feet-side pneumatic cylinder **94** is also provided with a boosting lever **98** extending rearward. Therefore, the ambulance officer present to the feet side can also operate the boosting lever **98** by foot, thereby easily raising the pressure in the cylinder and easily extending the piston rod **96**.

The other parts of the structure are the same as in Embodiment 3 and therefore description will not be given to them.

As described above, in this embodiment, the pneumatic cylinders **93** and **94** can be operated by foot to easily raise the bed **21** in the initial stage of the lifting work. Therefore, like Embodiment 3, the physical burdens of the ambulance officers can be reduced in the initial stage of the lifting work.

In addition, according to this embodiment, the ascending speed of the bed **21** can be easily controlled by controlling the operating speed of the boosting levers **97** and **98**. Therefore, in the initial stage of the lifting work, the lifting work can be smoothly done without giving the sick or injured person on the bed **21** an excessive physical burden.

Embodiment 5

As shown in Figure **14**, the stretcher **1** of Embodiment 5 includes as an initial ascent assist device hydraulic cylinders **153** and **154** with a built-in manual pump, instead of pneumatic cylinders **83** and **84** in Embodiment 3.

The head-side and feet-side hydraulic cylinders **153** and **154** are provided with boosting levers **157** and **158** for raising the hydraulic pressures in the cylinders, respectively. Like Embodiment 2, the head-side boosting lever **157** extends frontward beyond the bed **21** and the feet-side boosting lever **158** extends rearward beyond the bed **21**. Thus, the ambulance officers present to the head and feet sides can operate the boosting levers **157** and **158**, respectively, to extend the piston rods **155** and **156** of the hydraulic cylinders **153** and **154**.

The other parts of the structure are the same as in Embodiment 3 and therefore description will not be given to them.

Also in this embodiment, in the initial stage of the lifting work, the hydraulic cylinders **153** and **154** can be operated by foot to easily raise the bed **21**. Therefore, the physical burdens of the ambulance officers can be reduced, which provides the same effects as in Embodiment 1.

Also in this embodiment. the ascending speed of the bed **21** can be easily controlled by controlling the operating speed of the boosting levers **157** and **158**. Therefore, in the initial stage of the lifting work, the lifting work can be smoothly done without giving the sick or injured person on the bed **21** an excessive physical burden.

Embodiment 6

As shown in Figure **15**, the stretcher **1** of Embodiment 6 includes as an initial ascent assist device oil-hydraulic cylinders **163** and **164** with piston rods **165** and **166**, respectively, instead of pneumatic cylinders **83** and **84** in Embodiment 3.

At the head side of the bed **21**, an oil-hydraulic pump **55** is provided for supplying oil into the oil-hydraulic cylinders **163** and **164**. Note that though the oil-hydraulic pump **55** is provided at the head side in this embodiment, its shape, size and mounting position are not particularly limited. Though not shown, the bed **21** is provided with an intake switch and an exhaust switch both for turning the hydraulic cylinders **163** and **164** ON/OFF. The types of the intake and exhaust switches are not particularly limited. For example, the like elements as the intake switch **11**, **13** and the exhaust switch in Embodiment 3 can be suitably used.

The other parts of the structure are the same as in Embodiment 3 and therefore description will not be given to them.

Also in this embodiment, in the initial stage of the lifting work, oil-hydraulic pressure can be used to apply a large ascending force to the bed **21**. Therefore, the physical burdens of the ambulance officers can be reduced thereby providing the same effects as in Embodiment 3.

Also in this embodiment, like Embodiment 3, it is preferable to provide a speed control device for controlling the ascending speed of the bed **21**.

Embodiment 7

As shown in Figure **16**, the stretcher **1** of Embodiment 7 includes as an initial ascent assist device motor-driven actuators **123** and **124**, instead of the pneumatic cylinders **83** and **84** in Embodiment 3.

The motor-driven actuators **123** and **124** have extendable and retractable rods **125** and **126**, respectively. Like the piston rod **85** in Embodiment 3, the distal end of the rod **125** is connected to the connecting plate **87**. Further, like the piston rod **86** in Embodiment 3, the distal end of the rod **126** comes into contact with the projection **81** of the associated caster cover **80** for one rear leg **25**.

At the head side of the bed **21**, a battery **65** is provided for supplying electricity to the motor-driven actuators **123** and **124**. Note that though the battery **65** is provided at the head side in this embodiment, its shape, size and mounting position are not particularly limited. Though not shown, the bed **21** is provided with a switch for turning the motor-driven actuators **123** and **124** ON/OFF.

The other parts of the structure are the same as in Embodiment 3 and therefore description will not be given to them.

According to this embodiment, in the initial stage of the lifting work, the motor-driven actuators **123** and **124** can apply a large ascending force to the bed **21**. Therefore, the physical burdens of the ambulance officers can be reduced thereby providing the same effects as in Embodiment 3.

Also in this embodiment, it is preferable to provide a speed control device for controlling the ascending speed of the bed **21**.

Embodiment 8

As shown in Figures **17** and **18**, the stretcher **1** of Embodiment 8 includes as an initial ascent assist device a treadle lever **130** and a link mechanism **138** for converting a force of angular movement of the treadle lever **130** to an ascending force

of the bed **21**, instead of the pneumatic cylinders **83** and **84** in Embodiment 3.

The bed **21** is provided with a downwardly extending mounting plate **136**. A pin **135** is provided at the distal end of the mounting plate **136**. A connecting plate **134** is pivotally supported at an intermediate point to the pin **135**. An abutment **137** contactable with the projection **81** of the associated caster cover **80** is fixed to the rear end of the underside of the connecting plate **134**. The front end of the connecting plate **134** is supported pivotally to a connecting plate **133**.

The treadle lever **130** provided at the head side extends frontward beyond the bed. The root part of the treadle lever **130** forms a mounting part **131** pivotally mounted to the connecting plate **133**. The distal part of the treadle lever **130** is formed in a bar extending laterally (in the front to back direction of the paper in Figures **17** and **18**), and forms a pedal **132** which will be stepped on by an ambulance officer in the lifting work.

When an ambulance officer steps on the pedal **132**, the treadle lever **130** turns forwardly downward. The forwardly downward turn of the treadle lever **130** causes the connecting plate **134** to turn about the pin **135** as a pivotal point and thereby tilt forwardly upward. At this moment, the abutment **137** of the connecting plate **134** pushes down the projection **81** of the associated caster cover **80**. As a result, the front legs **24** receives forces toward deployment so that the bed **21** is given an ascending force. As can be seen from this, the connecting plates **133** and **134** constitute a link mechanism **138** for converting a turning force of the treadle lever **130** to an ascending force of the bed **21** (a force to raise the bed **21**).

Though not shown, the same link mechanism **138** is also provided at the feet side of the bed **21**.

In the initial stage of the work of lifting up the bed **21**, the ambulance officer steps on the treadle lever **130** by feet as well as using his own weight, thereby pushing down the distal part of the treadle lever **130**. Thus, the ambulance officers can easily

lift up the bed **21** to the halfway level without stooping. In addition, since the force obtained by stepping is greater than the lifting force by hands, the ambulance officers can exert greater strengths.

Therefore, also in this embodiment, the bed **21** can be easily raised to the halfway level without imposing large physical burdens on the ambulance officers.

In this embodiment, if the treadle lever **130** is slowly stepped on, the bed **21** can be raised little by little. Therefore, the lifting work can be smoothly implemented without possibility of large physical burden on the sick or injured person on the bed **21**.

Embodiment 9

As shown in Figures **19** and **20**, a stretcher **1** of Embodiment 9 is a combination of Embodiments 2 and 3. In other words, in this embodiment, a main ascent assist device for assisting the lifting work of the bed **21** in all stages of the lifting work is added to the structure of the stretcher of Embodiment 3.

As shown in Figure **19**, on the bottom of the bed **21**, a pair of head-side right and left pneumatic cylinders **8** and a pair of feet-side right and left pneumatic cylinders **9** are mounted. As described before, the piston rods **28** of the head-side pneumatic cylinders **8** are secured to a common slider **32** through drawing plates **6**, respectively, and a common drawing block **5**, while the piston rods **28** of the feet-side pneumatic cylinders **9** are secured to a common slider **31** through drawing plates **7**, respectively.

Figure **20** shows a piping diagram for high-pressure gas. The piping system **50** is, as in Embodiment 2 (see Figure **8**), composed of a head-side piping system **41** for controlling head-side pneumatic cylinders **8**, **83** and a feet-side piping system **42** for controlling feet-side pneumatic cylinders **9**, **84**.

A different point from the piping system in Embodiment 2 is that the

head-side piping system **41** contains a pipeline for operating the pneumatic cylinders **83**. Specifically, the head-side piping system **41** includes an air intake/exhaust switch **11b** formed of a mechanical valve, an intake pipe **43c** connecting the intake pipe **43a** and the air intake/exhaust switch **11b**, an intake pipe **44a** connecting the air intake/exhaust switch **11b** and each of the pressure chambers **51a** of the pneumatic cylinders **83**, and a release pipe **45a** connecting the air intake/exhaust switch **11b** and each of the vented chambers **52a** of the pneumatic cylinders **83**. One end of the intake pipe **43c** is connected in the intake pipe **43a** between the main switch **70** and the intake switch **11**.

Further, one end of an intake pipe **44b** is connected in the intake pipe **43b** of the feet-side piping system **42** between the intake switch **13** and the speed controller **47**. The other end of the intake pipe **44b** is connected to the pressure chamber **51a** of the pneumatic cylinder **84**.

In the operation of raising the bed **21** in this embodiment, the main switch **70** is first turned ON. Then, the air intake/exhaust switch **11b** is turned ON and the head-side and feet-side ambulance officers pull the head-side and feet-side unlocking levers **35a** and **35b**, respectively. Thus, the locking mechanism for the legs **22** are released so that the intake switches **11** and **13** are turned ON. As a result, high-pressure gas in the tank **10** is introduced into the pressure chambers **51a** of the pneumatic cylinders **83** and **84** as well as the pressure chambers **51** of the pneumatic cylinders **8** and **9**. Thus, the pneumatic cylinders **83** and **84** as well as the pneumatic cylinders **8** and **9** apply to the legs **22** forces toward deployment in the initial stage of the lifting work, and then the pneumatic cylinders **8** and **9** apply to the legs **22** forces toward deployment in the later stage of the lifting work. In this manner, the bed **21** is given an ascending force. Therefore, the ambulance officers can easily lift up the bed **21**. After lifting up the bed **21**, the ambulance officers release the unlocking levers **35a** and **35b** to lock the legs **22**.

As described above, the stretcher **1** has a power assist function for assisting the ambulance officers in lifting up the bed **21** in all stages of the lifting work. Therefore, the physical burdens of the ambulance officers can be extensively reduced. This makes it possible for even an ambulance officer with less muscle to smoothly lift up the bed **21**. In addition, the ambulance officers can reduce their fatigue due to the lifting work and can be prevented from straining their bodies (for example, their backs).

With, as in this embodiment, stretchers which raise the bed **21** by deploying the legs **22**, the load required to deploy the legs **22** is large particularly in the initial stage of the lifting work. Specifically, as shown in Figure **21**, the required load is largest when the bed **21** is at the lowest level and is sharply decreased with the ascent of the bed **21**. This relation between the required load and the level of the bed **21** is derived from the foldable structure of the legs **22**. The ascending direction of the bed **21** is the vertical direction and the component of the force toward deploying the legs **22** which contributes to the ascent of the legs **22** is limited to a vertical component force acting along the longitudinal direction of the main legs **24a** and **25a**. Therefore, when the bed **21** is still at a low level, the legs **22** have not yet sufficiently stood up. At this time, only a small vertical component force acts on them, which requires a large load to stand up the legs **22**. On the other hand, when the bed **21** reaches a high level, the bed **22** has stood up to some degree. At this time, the vertical component force acting on the legs **22** becomes large and therefore the required load becomes small.

As can be understood from above, if the stretcher includes only a main ascent assist device as an ascent assist device, the device should be a relatively large-capacity ascent assist device that can exert a large load required in the initial lifting stage. However, if the main ascent assist device is combined with the initial ascent assist device as in this embodiment, the required load of the main ascent assist

device can be reduced to a small extent. Thus, the main ascent assist device can be reduced in size and capacity.

Note that the high-pressure piping system for the above stretcher **1** is not limited to the above-described piping system **50** (see Figure **20**).

The actuators for the main ascent assist device are not limited to pneumatic cylinders but may be other types of actuators for giving the bed **21** an ascending force using high-pressure gas. For example, pneumatic motors can be used as actuators for the main ascent assist device.

The actuators are not limited to those using high-pressure gas but may be actuators using other types of drive sources. For example, oil-hydraulic or motor-driven actuators are also applicable.

The above actuators may be those giving an ascending force just to the bed **21**.

The main ascent assist device may be combined with the initial ascent assist device in any one of Embodiments 4 to 9.

Embodiment 10

Embodiment 10 relates to a system comprising a stretcher **1** and a vibration isolation platform **100**.

The stretcher **1** in Embodiment 10 is substantially the same as that of Embodiment **2**. Therefore, description will be made with reference to Figure **7** and detailed description will not be given.

The stretcher **1** of Embodiment 10 is different from that of Embodiment 2 in that on the bottom of the bed **21**, a limit switch **75** (see Figure **23**) is provided which is turned ON/OFF by a slider **33** slidable on a rail **27**. The mounting position and behavior of the limit switch **75** will be described later.

Figure **22** shows a piping diagram for high-pressure gas. The piping system **50** is, as in Embodiment 2, composed of a head-side piping system **41** for controlling

head-side pneumatic cylinders **8** and a feet-side piping system **42** for controlling feet-side pneumatic cylinders **9**.

The piping system in this embodiment is different from that in Embodiment 2 in that an exhaust pipe **74** is connected to the branch pipe **44** of the feet-side piping system **42**. The exhaust pipe **74** is connected with a changeover switch **75a** formed of a mechanical valve. This changeover switch **75a** is connected to the limit switch **75** and configured to change over by the turning ON/OFF of the limit switch **75**.

Next, description will be made of the structure of the vibration isolation platform **100** on which the stretcher **1** is to be put with reference to Figures **24** and **29**.

In this embodiment, use is made of the vibration isolation platform **100** equipped with a conveyer for automatically drawing the stretcher **1**. Note that the vibration isolation platform **100** is not limited to the particular type but various types of vibration isolation platforms can be used. Here, use is made of the vibration isolation platform disclosed in Japanese Unexamined Patent Publication No. 2002-153512. A brief description will be made below of the structure of the vibration isolation platform **100**.

As shown in Figure **24**, the vibration isolation platform **100** is installed in the ambulance vehicle **61**. The vibration isolation platform **100** is equipped with a hook carriage **103** for drawing the stretcher **1**, a guide rail **112** for guiding the hook carriage **103**, and a hook carriage drive mechanism **113** for moving the hook carriage **103** along the guide rail **112**. The hook carriage **103** and the hook carriage drive mechanism **113** constitutes a conveyer **140** for carrying the stretcher **1** onto the vibration isolation platform **100**.

The hook carriage drive mechanism **113** includes two sprocket wheels **101** and **114** a predetermined distance spaced apart from each other in the front to rear direction (right to left direction in Figure **24**), an endless chain **102** wrapped around the sprocket wheels **101** and **114**, and a driving gear **115** for rotating the sprocket

wheel **101**. The hook carriage **103** is attached to the chain **102**. Therefore, when the driving gear **115** rotates the sprocket wheel **101**, the chain **102** travels so that the hook carriage **103** attached to the chain **102** moves backward and forward.

As shown in Figure **29**, the hook carriage **103** is provided with a roller **109** for rolling in and along the guide rail **112**, and a mounting piece **116** to which the chain **102** is attached. A hook **106** is pivotally attached to one end of the hook carriage **103** via a shaft **108**. A hook guide roller **105** is provided at part of the hook **106** toward the distal end thereof. The distal end **104** of the hook **106** is bent upward in an L-shape. Therefore, the distal end of the hook **106** is formed to engage the shaft **37** of a carrying-in/out guide roller **36** provided at the front end of the stretcher **1**.

A hook guide rail **107** is provided at the rear end of the guide rail **112** (right end thereof in Figure **29**). The hook guide rail **107** inclines gently downward from the guide rail **112** toward its rear end and the rear end has a large angle of inclination to form a sharp inclined surface **107a**.

With this structure, the hook carriage **103** automatically engages the stretcher **1** in the carrying-in of the stretcher **1**. Further, in the carrying-out of the stretcher **1**, the hook carriage **103** automatically releases the engagement with the stretcher **1**.

Specifically, in the carrying-in of the stretcher **1**, the hook carriage **103** goes forward so that the hook guide roller **105** moves forward on the sharp inclined surface **107a** of the hook guide rail **107**. With the advance of the hook guide roller **105**, the hook **106** pivots upward so that the distal end **104** of the hook **106** is raised up to a level higher than the shaft **37** of the stretcher **1**. Then, the hook **106** engages the shaft **37** of the stretcher **1** (see Figure **30**). Thereafter, with the advance of the hook carriage **103**, the stretcher **1** is drawn forward (see Figure **31**).

On the other hand, in the carrying-out of the stretcher **1**, the hook carriage **103** moves toward the rear end of the guide rail **112** along the guide rail **112** so that the hook guide roller **105** transfers from the guide rail **112** to the hook guide rail **107**.

Then, after the hook guide roller **105** reaches the sharp inclined surface **107a** of the hook guide rail **107**, the hook **106** gradually downwardly pivots with the downward movement of the hook guide roller **105** along the inclined surface **107a**. Finally, the distal end **104** of the hook **106** goes down to below the shaft **37**. As a result, the engagement of the hook **106** is automatically released.

The operations of lowering and raising the bed **21** of the stretcher **1** in this embodiment are the same as in Embodiment 2. Therefore, description will not given to them. Here, description will be made of the operation for carrying the stretcher **1** on the vibration isolation platform **100** in the ambulance vehicle **61**.

First, the ambulance officer **91** drives the driving gear **115** of the vibration isolation platform **110** to move the hook carriage **103** to the rear end of the guide rail **112**. Next, as shown in Figures **24** and **29**, the ambulance officer **91** positions the stretcher **1** such that the shaft **37** of the carrying-in/out guide roller **36** of the stretcher **1** comes to above the hook distal end **104** of the hook carriage **103**.

Next, the ambulance officer **91** drives the driving gear **115** in the reverse direction to move the hook carriage **103** forward. Thus, as shown in Figures **25** and **30**, the hook **106** engages with the shaft **37** of the carrying-in/out guide roller **36** of the stretcher **1** so that the stretcher **1** can be drawn by the hook carriage **103**.

At this time, the ambulance officer **91** pulls the unlocking lever **35b** of the stretcher **1** to release the legs **22** from their locking state. The unlocking lever **35b** is configured to release both the locking mechanisms for the front and rear legs **24** and **25**. Since the pressure chambers **51** of the pneumatic cylinders **8** and **9** are filled with high-pressure gas, an ascending force is applied to the bed **21** even if the lock of the legs **22** is released. Therefore, the ambulance officer **91** can support the bed **21** with small strength. If the pressure of high-pressure gas in the pneumatic cylinders **8** and **9** is set relatively high, the raised position of the bed **21** can be kept even if the ambulance officer **91** applies any force to the bed **21**.

Next, as shown in Figure **26**, when the drawing of the hook carriage **103** proceeds, the front legs **24** of the stretcher **1** abut on the rear end of the vibration isolation platform **100**. Then, during further forward movement of the stretcher **1**, the front legs **24** receive a backward force from the rear end of the vibration isolation platform **100** and is thereby automatically folded up.

As shown in Figure **23** (where the hook carriage **103** is not given in Figure **5**), with the folding motion of the front legs **24**, the slider **33** at the front side of the stretcher **1** moves backward. Then, when the length of part of the stretcher **1** laid on the platform reaches a predetermined value, the slider **33** passes through the limit switch **75** as shown in the dot-dash line in Figure **23** to turn the limit switch **75** ON. Thus, the changeover switch **75a** (see Figure **22**) is changed over. As a result, high-pressure gas stored in the pressure chambers **51** of the feet-side pneumatic cylinders **9** is discharged through the exhaust pipe **74** to the outside. Thus, the rear legs **25** become foldable.

Thereafter, the hook carriage **103** further draws the stretcher **1** forward (see Figure **27**). When the entire stretcher **1** is laid on the vibration isolation platform **100**, the driving gear **115** is stopped to complete the carrying-in operation (see Figure **28**).

As seen from the above, in putting the stretcher **1** on the vibration isolation platform **100** in this embodiment, the locking mechanism for the legs **22** is released. Since, however, the pneumatic cylinders **8** and **9** apply to the legs **22** forces toward deployment, the bed **21** is given an ascending force. Therefore, the ambulance officers **91** can hold the bed **21** in a raised position with relatively small strength or no strength. Hence, the physical burdens of the ambulance officers can be reduced. Further, the ambulance officers **91** are not given a shock so that their bodies are less likely to be strained.

Further, even after the front legs **24** are folded up, the pneumatic cylinders **9** hold the rear legs **25** in a deployed position until the limit switch **75** is turned ON.

Therefore, even when the front legs **24** are folded up, the ambulance officers **91** do not receive large physical burdens.

When the length of part of the stretcher **1** laid on the platform reaches the predetermined value, the limit switch **75** is turned ON so that high-pressure gas in the pneumatic cylinders **9** is released to the atmosphere. Thus, the rear legs **25** become foldable. Therefore, the carrying-in operation of the stretcher **1** can be smoothly carried out. When high-pressure gas in the pneumatic cylinders **9** has been released to the atmosphere, the force to raise the bed **21** is eliminated so that a certain amount of physical burden may be applied to the ambulance officer **91**. However, when the length of part of the stretcher **1** laid on the platform reaches the predetermined value, the front side of the stretcher **1** is supported on the vibration isolation platform **100** so that the vibration isolation platform **100** can bear most weight of the stretcher **1**. Therefore, the physical burden of the ambulance officer **91** can be reduced.

Furthermore, since in this embodiment the vibration isolation platform **100** is provided with a hook carriage **103** for drawing the stretcher **1**, the stretcher **1** can be pulled onto the vibration isolation platform **100** without the need for the ambulance officer **91** to push the stretcher **1**. Therefore, the physical burden of the ambulance officer **91** can be reduced. In addition, even when the road is slippery, for example, due to icy conditions, the stretcher **1** can be carried in the ambulance vehicle with expedition and safety.

As described so far, according to this embodiment, the ambulance officers **91** can carry the stretcher **1** in the ambulance vehicle with ease, expedition and safety.

The conveyer for carrying the stretcher **1** onto the vibration isolation platform **100** is not limited to the conveyer for drawing the stretcher **1** using the hook carriage **103** but other types of conveyers are also applicable.

The support platform for supporting the stretcher **1** is not limited to the vibration isolation platform **100**. The support platform is not limited to one installed

on the ambulance vehicle but may be installed at other sites such as hospitals. Examples of the support platform include the floors of ambulance vehicles.

The conveyer **140** is not always mounted on the vibration isolation platform **100** but may be mounted on the ambulance vehicle itself.

Industrial Applicability

As described so far, this invention is useful especially for a stretcher used for carrying a sick or injured person in an ambulance vehicle, for example, at an ambulance work site.